**Original Manuscript ID:** Access-2022-25705

**Original Article Title: “**CNN Sensor Analytics with Hybrid-Float6 Quantization on Low-Power Embedded FPGAs.”

**To:** IEEE Access Editor

**Re:** Response to reviewers

Dear Editor,

Thank you for allowing a resubmission of our manuscript, with an opportunity to address the reviewers’ comments.

We are uploading (a) our point-by-point response to the comments (below) (response to reviewers), (b) an updated manuscript with yellow highlighting indicating changes (*Supplementary Material for Review*), and (c) a clean updated manuscript without highlights (*Main Manuscript).*

Best regards,

Yarib Nevarez et al.

**Reviewer#1, Concern # 1:** Line numbers are missing from pages 11, 12, and 15.

**Author response:** Sorry for this problem. But as far as I noticed this problem should have been generated in the PDF version by the submission tool.

**Author action: -**



**Reviewer#1, Concern # 2:** Page 6: column 2, Figure 5: You show the output as 32-bit floats. However, Figures 6 and 7 show 64-bit outputs. Is this a typo in Figure 5?

**Author response:** Thank you for your comment and sorry for the confusion caused by our description. The hardware dot-product produces a 32-bit float, which is the normalized value of the internal accumulator. This accumulator is a register of 64-bit fixed-point with 23-bit fraction. This is stated in Section IV.-B-2 and in Figure 7.

**Author action:** We updated the manuscript by clarifying this point in Section IV.B-2.



**Reviewer#1, Concern # 3:** Page 11, column 1, Figure 12: The CNN regression model proposed has very few layers. It would be interesting to see your proposal implemented in a more SOTA CNN, such as Yolo V7.

**Author response:** We completely agree. Since, SOTA CNN, such as Yolo V7 are out of the scope of low-power sensor analytics, this is would be part of a future work.

**Author action:** We updated the manuscript by adding this point in Section V.D-4.



**Reviewer#1, Concern # 4:** Page 11, column 1, around line 50: 10 epochs and such small sample sizes, while possibly stretching your proposed model, are insignificant to a more SOTA model.

**Author response:** Yes, exactly. It is insignificant compared to SOTA models since they are designed for computer vision applications, which require higher capacity of feature extraction.

**Author action: -**



**Reviewer#1, Concern # 5:** Page 11, column 2, around line 55: "imput". Spell and grammar check the document.

**Author response:** Thank you very much.

**Author action:** We updated the manuscript by correcting the misspelling.



**Reviewer#1, Concern # 6:** Page 11, column 2, around line 45: How long did Hybrid Log 6-bit QAT take?

**Author response:** The QAT time is 185 minutes. This is stated at the end of Section V. B-4.

**Author action: -**



**Reviewer#1, Concern # 7:** Page 13, column 2, Figure 15: For ease of reading, please label your axes.

**Author response:** Yes.

**Author action:** We updated the manuscript by adding the axes.



**Reviewer#1, Concern # 8:** Page 15, column 1, Figure 17: The figure appears to have an Error distribution and two versions of the Loss Distance Histogram. Is this intentional?

**Author response:** Yes, it is intentional. The loss distance histograms show the quantization effect on the X- Y- regression results. Fig. 18(b) shows this effect on three different models. Vertical and horizontal patterns appear in the error distribution of 8-bit fixed-point quantization. The figures are intended to illustrate this effect. We stated this point in Section V. D-1

**Author action: -**



**Reviewer#2, Concern # 1:** The flowchart of the software that was downloaded on the Cortex-A9 processing system (PS).

**Author response:** Thank you for your comment. We completely agree.

**Author action:** We updated the manuscript by adding the software flowchart in Section IV.D.



**Reviewer#2, Concern # 2:** There are some sentences that needed to be reviewed again.

**Author response:** Thank you very much for your detailed review.

**Author action:** We updated the manuscript by addressing all the points.

**Reviewer#2, Concern # 3:** Page 6, line 57 of-chip –> off-chip

**Author response:** Thank you for your comment.

**Author action:** We revised the manuscript by correcting the misspelling.

**Reviewer#2, Concern # 4:** Page 8, line 44, you need to mention the unit of the grid dimension (10x10)!

**Author response:** The 10x10 grid are divisions on the metal plate area (90 cm x 86.6 cm).

**Author action:** We updated the manuscript by clarifying the grid division on the metal plate area.

**Reviewer#2, Concern # 5:** Page 10, col 2 , last paragraph “imput” change to (input)

**Author response:** Thank you for your comment.

**Author action:** We revised the manuscript by correcting the misspelling.

